RAILWAY SURGEONS

SUBCUTANEOUS INJURIES OF THE ABDOMINAL CONTENTS.*

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Subcutaneous injuries of the abdomen can be produced in various ways, being caused from blunt violence, such as blows, kicks or falls upon the buttocks or feet, or being run over by vehicles, compression of the abdomen between two hard objects, etc. A direct blow may rupture an underlying solid organ, such as the liver, spleen or kidney, or may burst a hollow organ, such as the gall bladder, urinary bladder or intestine, or in some cases may cause the compression of the viscera against the spine or pelvis; a fractured rib may injure the liver, or fractured pubes may injure the urinary bladder. A fall from a height may tear loose certain portions of the abdominal viscera or rupture vessels in the mesentery.

The history of the injury or outward evidence on the abdominal wall may aid in locating the injured viscera. Again, the injury may be multiple or an injured intestine may not slough for many days, or if the injury is of such a nature as to tear loose the mesentery from the gut, gangrene and perforation may not occur for several days.

The correct diagnosis of abdominal injuries is the all-important factor in the management of this class of cases. The first question that confronts us is: Is the patient suffering from shock, internal hemorrhage, rupture of the gastro-intestinal tract, or rupture of some of the other organs, such as the spleen, liver, kidney or pancreas? Or, have you a combination of these symptoms, such as shock and hemorrhage, rupture of the intestinal tract with mesenteric hemorrhage or rupture of some of the solid organs with hemorrhage? Any and all of these symptoms may be attended with shock. Or, is the patient suffering from shock and a slow oozing internal hemorrhage, which may show signs of clearing up from the symptoms of shock and then lapse into a second condition from the hemorrhage?

The differentiation between shock and hemorrhage should be first determined, then as to whether rupture of the alimentary tract exists. These two conditions, shock and hemorrhage, have certain symptoms in common. The error of mistaking shock for concealed hemorrhage can be easily made.

The general symptoms in shock may be progressive, but in hemorrhage are always progressive. The local symptoms in shock may be absent, whereas in hemorrhage they are often present, such as abdominal distension, vomiting, hematemesis and hematuria. The mentality in shock is dull, in hemorrhage always active. Restlessness in shock is slight, in hemorrhage often very great. The pallor in shock is moderate, in hemorrhage it is very great, especially of the mucous membranes, and is progressive. Sweating in shock is frequently present, in hemorrhage usually absent. Respiration in shock is rapid, in hemorrhage marked and increasing air-hunger. The pulse in shock is rapid and weak, in hemorrhage grows more and more rapid and weak. The effect of stimulants in shock is more or less lasting, but very transitory in hemorrhage. Specific gravity of blood in shock is increased, in hemorrhage decreased. This is the most reliable test we have for differentiating between shock and hemorrhage, the technic of which is very easily carried out and can be done with the ordinary instrument used in taking specific gravity of the urine. This method was first referred to by Vale in the *Medical Record* of August 27th, 1904.

In ruptures of the alimentary tract, the patient feels severe pain at the seat of rupture. You here have the symptoms of shock but not so marked lowering in blood pressure. The pain continues unabated, there is local rigidity and tenderness of the abdominal wall, nausea and sometimes vomiting. In ruptures of the gut, vomiting is usually present, not always so in ruptures of the stomach, but nausea is present.

Continued vomiting after these injuries strongly suggests injuries of the alimentary canal, as in shock one or two vomitings are common, but not frequently repeated vomiting. Blood in the vomit suggests injury to the stomach, not necessarily perforation. Escape of gas from the intestinal tract causes gradual distension of the abdomen, which may give rise to exaggerated tympanitic resonance around the umbilicus or a diminution or absence of the liver dullness. The evidence of free fluid in the abdominal cavity will not be present unless the quantity of escaped contents is very large, then there will be dullness in the flanks, and such dullness is usually more marked in the region near where the perforation took place. After a few hours you have the symptoms of diffuse purulent peritonitis. In the cases complicated by rupture of solid organs or by rupture of blood vessels, the early symptoms will be rather those of shock and acute progressive anemia, together with the local signs already mentioned.

It is not my purpose to consider shock, hemorrhage, collapse or rupture of the intestinal tract further than its connection with subcutaneous injuries of the abdomen, but it is necessary, as near as possible, that we determine from which of these conditions our patient is suffering. If he is suffering from shock, what shall be our line of treatment? If he is suffering from hemorrhage, what can be done for the patient? Or, if there is rupture of the intestinal tract, what course shall we pursue?

If the patient is suffering from shock, the impression upon the central nervous system, namely, the brain cells, is temporarily the same as that of hemorrhage. You have a cerebral anemia. In shock, the blood is contained in the splanchnic blood vessels, in hemorrhage, the blood is free in the abdominal cavity, so that in both conditions the brain cell is lacking in nourishment, and if this stage of anemia or lack of nourishment goes beyond a certain point, it is impossible for the brain cell to return to its normal condition, and the further this stage of anemia is carried on, as has been pointed out to us by Dolley, Crile, Stewart, Hill and several others, the more slowly does the brain cell return to its normal condition. Stewart has shown us, and this has been followed up also by Dolley,

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Crile and others, that tissues or organs of low specialization endure anemia better than tissues or organs of high specialization, and that in the central nervous system component parts endure anemia in proportion to the high development of the nerve cells. They have pointed out to us that the weakest link in the entire vital chain in the cerebral nervous system is that which presides over conscious life and its special manifestations. The higher the development of the tissues the more sharply is the period of endurance to anemia marked.

The review of these pathological conditions will be an important guide to us in the future management of the case. If the patient is suffering from either shock or hemorrhage, it will be an important step in the line of treatment to lower the head of the patient in order to give better cerebral nourishment until such time as we have determined what further procedure will be necessary. If there is rupture of the intestinal tract, it will probably do no good to lower the head of the patient, but at the same time, will do no harm.

At this point I feel the necessity of mentioning the dangers which sometimes come from lowering the head of patients during shock or hemorrhage. This, of course, is the ideal procedure, as it relieves the pathology by giving the brain more nourishment, but there are certain contra-indications to this procedure and your patient should be very closely watched while in this position, especially if the general make-up, age, etc., of the patient would lead you to suspect a weak heart muscle. If the patient's head is lowered too much, the blood will gravitate into the right and left auricle of the heart, which have much less contracting power and strength than the ventricles, thereby causing a great amount of blood to be contained in the auricles of the heart, and if the position is too exaggerated, the blood will be caused by gravity to stay in the auricles. The contracting power of the auricles already being interfered with, both on account of gravity and their weakened condition, your pathology is increased instead of being relieved, but the blood pressure of the patient, his general condition and the increase of dullness of the heart to the right side must be watched. When it is found that the auricles are filling up, the patient should be lowered for a time and then again raised slightly and should be very carefully watched to ascertain whether this change of position increases or decreases the blood pressure.

The history of the injury is very important. Ascertain, as near as possible, the exact manner of the injury and go over the general condition of the patient. The results of local examinations often reveal the exact location of injured viscera. Have the patient catheterized to see if the urine contains any blood. If the urine does contain blood, a catheter should be introduced and the bladder washed clean with normal salt solution, the bladder then refilled with water and after waiting a few minutes again emptied with the catheter. If the blood is coming from the ureter or kidney, the fluid will be clear or slightly stained with blood. If the blood is coming from the bladder wall or prostatic urether, the mechanical irritation of washing will usually cause the continuance of blood so that the contents of the bladder becomes bloody at once, and the continuance of the washing results always in the evacuation of bloody fluid. Of course, the first washing should be thorough, in order to wash out any clots that may be in the bladder. When clots are found, the hemorrhage is very often from the bladder wall. Of course, this cannot always be determined without the use of a cystoscope. The location of the injury will often lead to the suspicion of either a bladder or kidney injury.

A very important point in making a diagnosis is to ascertain the length of time since the patient was injured and, if possible, to find out whether the patient is growing rapidly worse, in other words, are the symptoms of pallor, rapid respiration or air-hunger, restlessness or pain increased since the time of injury, or has the patient slightly improved. If so, the improvement being only transient, it might indicate that the initial shock had partly passed away and that hemorrhage was gradually taking place.

The indiscriminate use of stimulants is here contra-indicated, as the patient may be suffering from hemorrhage, and if suffering from shock it has been pointed out to us by many investigators that the ordinary use of stimulants, such as strychnia, nitroglycerin and others only tends to increase the pathology that already exists.

I have had the opportunity of being present in the Western Reserve University, Cleveland, Ohio, when experiments were made in cases where transfusion of saline or blood was resorted to, or the use of adrenalin. It was very interesting to note how short the action of adrenalin was upon such cases, and again to note the transitory action of saline in comparison with blood transfusion, saline, however, lasting much longer than adrenalin, which lasted only from five to fourteen minutes, while saline lasted from twenty minutes to an hour and a half. The effect of blood transfusion seemed to be decidedly permanent.

So it will be seen that we can only arrive at a proper conclusion after a careful diagnosis of the condition. Our diagnosis having been made, the treatment suggests itself. Should the condition be shock, which is very severe in some cases that I have seen, it would give a strong suspicion of hemorrhage until the case was diagnosed. If we attempt immediately to open the abdomen of a patient in severe shock and manipulate the internal viscera looking for some lesion, it will only tend to increase the condition that already exists. Therefore, during the first few hours or immediately after injury, if a diagnosis of hemorrhage is not made, the patient should be watched rather than rushed to the operating room. If the patient is brought to the surgeon in a state of severe shock, as for instance, from a mutilating trauma, he will have to decide whether to superimpose upon the existing condition the shock or ether and operation or to temporize and combat shock before operating. There seems to be a growing tendency in favor of the latter course. Many a patient, as a last hope rushed to an operation, has expired, where the operative risk might have been

lessened if a few hours had first been devoted to the treatment of shock.

On the other hand, if a diagnosis of hemorrhage is made, which I think generally can be, after watching the patient for a short time, if the condition of shock is not too pronounced, preparation should be made for opening the abdomen. The location of the injury will often be a guide as to where the abdomen should be opened.

In the emergency preparation of these cases, the abdomen should be thoroughly cleansed over its entire area, as a second incision may be necessary. A large incision should be made as it will not increase the already existing shock as much as severe manipulation of the internal viscera.

During the operation much may be done to forestall shock. If shock is expected, all precautions should be taken and everything made ready for the treatment of post-operative shock, while the operation is going on. The operation should be rapid. All preparations should be made and well planned before it is started. All means should be taken to prevent the loss of body heat. Body and limbs should be wrapped in blankets and heat applied upon the operating table. Special care should be taken that the patient is not lying exposed upon an uncovered cold glass table, especially in operations of length. Loss of blood should be scrupulously avoided. All unnecessary exploration and manipulation of the intestines should be guarded against.

Crile has recently demonstrated on animals that the main factor in shock is the general fall in blood pressure in the peripheral arteries and the coincident rise in pressure in the vessels of the portal system.

If hemorrhage from any of the solid organs exists, ligation of any of the larger vessels of such organ should be attempted, and if it be a general oozing from the surface of the rupture of such organ, suture should be attempted. It is true that many of these cases are fatal, but the cases are desperate to begin with, and we have to do something to make an attempt to save the life of the patient. Where statistics show a very high mortality in this class of cases, recovery often occurs, which would not without surgical interference.

If rupture of the intestinal tract exists, the treatment suggests itself. The opening should be closed but the abdomen should be drained; and especially so if the large intestine is ruptured, as the colon bacillus and other bacteria are more numerous in the large than in the small intestine.

Wounds of the spleen should be sutured and hemorrhage controlled, but in very extensive laceration, splenectomy is infinitely the safer procedure.

Discussion.

Dr. Robert T. Legge, McCloud: This paper which Dr. Hamlin has just read is similar to the one I read before our society last year. I wish to emphasize some of his remarks in regard to the treatment of these cases. In many of these cases that come before us, during the first few hours the only symptom complained of by the patients is the severe pain, and we find it very difficult to diagnose early the difference between shock and severe hemorrhage. Taking the specific gravity of the blood to differentiate between these two conditions is an ideal method. I claim that all severe abdominal injuries should be operated at once, because later on where there is considerable hemorrhage and shock most of the patients die. No so-called conservate treatment or the waiting for reactions is permissible. In reference to the external marks of violence, I have noticed that in two of my cases there were none existing; but upon operating I found a ruptured intestine and a ruptured liver.

Dr. W. I. Terry, San Francisco: I wish to emphasize the matter of waiting for some recovery after shock, when the diagnosis can be made of shock and not of hemorrhage, or shock with a small amount of hemorrhage. It seems to me a better proposition to wait for some return. The reader of the paper spoke of the rapid preparation of the abdomen for operating in these cases that it should be thorough, but I find that a simple preparation of the abdomen can be made which is just as free from danger of infection as the more complicated methods. If the shaving of the skin be done by the dry method and the abdomen painted with diluted tincture of iodin, the disinfection is just as good as the scrubbing and the prolonged methods ordinarily employed.

HOSPITAL SERVICE FOR RAILROAD CONSTRUCTION CAMPS IN THE PACIFIC NORTHWEST.*

By WM. O. SPENCER, M. D., Huntington, Ore.

Living in a part of the country whose extensive natural resources are under process of development, my practice for a considerable portion of the last nine years has included contract hospital service for construction and mining companies. Therefore, in accepting the invitation to read a paper before this Association, it occurred to me that I might appropriately present this subject by detailing some phases of my experience in such work.

For a period of eighteen months from April, 1908, it fell to the lot of the writer to furnish hospital service to two construction companies in the same locality. One was doing the grading for sixty miles of railroad along the Snake River northward from Huntington, including a tunnel twenty-four hundred feet in length through a spur of the mountains, around which the river flows, forming what is known as the Oxbow. The other company was driving a second tunnel fifteen hundred feet long and twice the size of the railroad tunnel through this same mountain for the purpose of diverting through it the waters of the river from its circuitous course of four miles, thereby securing a fall of some forty feet for the generation of power.

The camps of this latter company were, of course, concentrated at the location of this tunnel. The railroad construction company established camps at different points along the line of the proposed railroad, with the largest and more permanent one at the long tunnel.

A village called Copperfield, typical of western frontier life, sprang up near the main camps of the two companies, and here I erected a rough frame building and equipped it for hospital purposes, employing for its maintenance a physician and a nurse.

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